DEPARTMENT OF NATIONAL DEFENCE
CANADA

OPERATIONAL RESEARCH DIVISION

PERSONNEL OPERATIONAL RESEARCH TEAM

RESEARCH NOTE 9704

THE 1997 GENERIC OFFICER MODEL: AN OVERVIEW

BY

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and
Dr A. Jesion

August 1997

OTTAWA, CANADA

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Recommended by: _____ Team Leader

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ABSTRACT

This research note provides sponsors and analysts with an overview of the Generic Officer Model currently in use by the Personnel Operational Research Team (PORT). This particular model, which was developed using the Generic Modelling (GeM) utility, is now operational in a Windows 95 environment. New features of the Generic Officer Model include the ability to model an Officer Forces Reduction Plan (FRP); an improved model of the Engagement Conversion Process; and the assessment of Run Accuracy. The Generic Officer Model continues to evolve in response to changing personnel policy plans and various other sponsor requirements.

RÉSUMÉ

La présente note de recherche offre aux organismes parrains et aux analystes une vue d'ensemble du modèle générique destiné aux officiers (MGO) qui est actuellement utilisé par l'Équipe de recherche opérationnelle en personnel (EROP). Ce modèle, conçu à l'aide du programme de modélisation générique (GeM), est maintenant opérationnel dans le cadre d'exploitation de Windows 95. Les nouvelles caractéristiques du MGO comprend la capacité de modéliser un Programme de réduction des Forces (PRF) pour les officiers; un nouveau modèle du processus de conversion des conditions de service;et la confirmation de l'exactitude de l'exécution (Run Accuracy). Le MGO continue à évoluer en réponse aux changements à survenir dans les programmes de politique du personnel et aux différentes exigences exprimées par les organismes parrains.

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I. INTRODUCTION

1. The Personnel Operational Research Team (PORT) provides analytical and statistical support to National Defence Headquarters (NDHQ) personnel planning staffs. PORT is frequently called upon to examine the long-term implications on military occupational (MOC) structure of short-term fluctuations in military staffing policies - such as those relating to recruitment and retention, for example. One of the more valuable tools used in this work is manpower modelling. The Generic Officer Model, the subject of this research note, is one of many models in PORT's inventory and has seen regular use as a policy assessment tool.

2. The Generic Officer Model is a time-stepped simulation of personnel flow through a career management system. The model applies MOC-specific career progression, engagement conversion, and attrition rules to an officer population over a given time horizon. The model also includes MOC - qualified entry, actively (through committed production in the training pipeline) or passively - to sustain preferred manning levels (PMLs). The changes to the MOC which occur as a result of the application of personnel policies (taking into account related personnel factors such as attrition) are monitored throughout the time horizon and are summarized in the model's output.

3. The Generic Officer Model has grown since it was first developed in 1992. (Reference 1) Much of this growth was motivated by both the inclusion of several new issues in officer modelling and product improvement to the Generic Modelling (GeM) utility. Recent changes described in this paper include the following:

a. modelling of an Officer Forces Reduction Plan (FRP);
b. improvement to the modelling the Engagement Conversion Process;
c. assessment of run accuracy; and
d. run-time generation of output graphs.

4. The Generic Officer Model has been used to support the following personnel policy initiatives:

a. Annual Military Occupational Reviews (AMORs);
b. training and promotion implications following either PML reduction or the application of changes to the Officer Career Development Plan (OCDP) gates;
c. the forecast of numbers and ranks of officers accepting FRP offers; and
d. the assessment of the incremental training impact of an MOC restructure proposal.

5. The Generic Officer Model does not replace, in any way, the career management function. However, this model is useful in making projections (i.e. answering "what if" questions) which would be too tedious or impossible for a career manager to undertake. Model results, **in conjunction with appropriate analyses**, provide career managers and senior management with the data required to support timely and informed decision-making. Thus, the Generic Officer Model is often classified as a decision support model.

Aim

6. The aim of this research note is to provide sponsors and analysts with an overview of the modelling methodology employed within the Generic Officer Model.

Scope

7. This research note describes the Generic Officer Model as of August 1997. It is not a user manual and does not provide the details required by GeM-proficient personnel to maintain the Generic Officer Model. It is anticipated that such a user manual will be written as well. This paper does include a brief description of the Windows 95 evolution of the GeM utility and a discussion of possible directions for the further development of the Generic Officer Model.

II. WINDOWS 95 GeM OVERVIEW

Background

8. A description of the Generic Officer Model cannot be complete without some mention of its development platform, the Generic Modelling (GeM) utility, which is a multi-faceted tool for building fixed time-step simulation models. It was developed by the Cody Group under contract to the Department of National Defence (DND) for the Directorate of Manpower Analysis (D Man A). As a result, most of its application has been in Human Resource Management (HRM). Nevertheless, the GeM model building constructs are capable of representing a much broader range of modelling situations.[1] This portion of the research note provides a brief introduction to GeM vocabulary sufficient to understand the Generic Officer Model.

9. GeM derived models are assembled from elements of a "tool kit". An understanding of the Generic Officer Model can only be gained concurrently with an appreciation of GeM tool kit components and their behaviour. As the GeM package is still in development, a comprehensive set of user manuals is not available. (Reference 2 provides some background information about the development of the original GeM utility and Reference 3 is the current GeM Modelling Course for GeM version 4.0.3 for Windows 95.)

GeM Design Philosophy

10. GeM is unlike other commercially available simulation design packages. Its main functional components, "nodes" and "links", bear only a superficial resemblance to similar constructs in other packages. It supports object-oriented model design while catering to the dynamic situations typical of expert systems. As a result, model builders using GeM must apply a different way of thinking about model design.

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[1] Indeed, the limited range of problems tackled may be the biggest impediment to the wider use of GeM.

11. As the Generic Officer Model is closely associated with the GeM utility, it must be understood that, in this paper, a model refers to an organized collection of GeM objects whose behaviour when run, simulates real-world events. In contrast, GeM, the tool used in building models, is never called a model. Criticism of a model often deals with its misrepresentation of real-world events, and as a result, the model designer must be vigilant in obtaining a good understanding of both real-world events and the functioning of GeM objects.

12. The relation of GeM to its model is comparable to that of vocabulary and grammar to an essay. One seldom faults a language for a poorly expressed idea. So to, the GeM utility should not be faulted for a poorly constructed model. The latter mainly reflects the skill with which the model designer applies GeM constructs.

The Windows 95 Evolution of GeM

13. Originally GeM was developed as a family of executable programs that operated in the OS/2 environment. The most recent version of GeM now operates in the Windows 95 environment with the use of a Graphical User Interface (GUI). The GeM environment is comprised of several internal and external programs or utilities. GeM builds and runs fixed time step simulations. These programs include the following:

a. Gembuild.exe - the model builder;
b. Gemexec.exe - the model running utility;
c. P4.exe and Show.exe - required for output/graphing (and they cannot be executed on their own);
d. Prolog.err - an error file used by Gembuild.exe to display error messages; and
e. Gembuild.hlp - a help file containing the online context sensitive help messages.

14. While running a "built simulation" is straightforward, building a simulation is much more involved. The GeM model builder, through its menu system, supplies general-purpose objects (templates). Users assemble combinations of

these templates to build their models. Intelligent use of GeM thus involves a thorough understanding of the modelling situation as well as the skill to apply its objects to the modelling task.

Basic GeM Constructs

15. The "node" and the "link" are the basic components used in building models. (Circles are usually associated with nodes and arrows with links in pictorial representations of GeM-derived models.) Nodes are place holders describing an aspect of the model state. They define model resources in a certain way. Links are mechanisms for making changes to resources. Nodes and links work on entities from specific resource classes. The critical resource class in personnel applications is called a person, represented by a systematic list of personnel attributes.

16. There are other GeM templates and facilities which will be described briefly later in this portion of the paper. These are used:

a. to define and manage information/databases (i.e. about resources and their various attributes);
b. to contain rules which govern the model (based on both modelling requirements and personnel policies);
c. to contain details concerning model execution (such as the order of events in a simulation);and
d. to carry out various model output (documentation) facilities.

Nodes

17. In military HRM applications, nodes keep track of the number of personnel who are at a certain classification level or terms of service contract. In effect, a node only maintains counters: the number of people in a personnel database meeting the node definition, the desired population level, intake restraints, etc.

Resource Classes and Their Attributes

18. Military HRM studies keep track of groups of personnel who have particular attributes such as MOC, rank, years of service, etc. These personnel groups are called resource classes in GeM terminology. A resource instance is one representative of the resource class. In a general sense, within GeM, resource classes can be any systematic grouping of attribute data.

Links

19. Links filter all members in a specified resource class according to a set of attribute dependent instructions. For example, a link could restrict its action to all officers within a certain age range, at a certain rank level, and at given classification level. The counters associated with a node determine whether or not there is a particular staff shortfall, dependent on various rules defined by the GeM model builder. An attached link, when it "fires", updates the personnel database in accordance with the link's specifications. Furthermore, the link updates the counters of any attached nodes. The simultaneity of these events creates the illusion of storage of actual resources at the nodes. It is emphasized that system messages directed at a node make attached links produce database changes.

20. A model built with the GeM utility exhibits behaviour which is primarily dependent on the node and link information. Constraints are particularly important and can be something like a maximum intake limit (a node specified constraint) or the completion of a training course (a link constraint). A variety of node and link controls dictate what will happen and how that process will proceed.

21. There are two means ("attributes" in GeM terminology) which control link information. The first is a list (a "match list" in GeM terminology) which specifies the criteria for link activation, such as officers with a specific engagement type. The second attribute specifies the actual transformation which will occur for "successful" candidates, such as the conversion from one engagement contract to another.

22. Furthermore, a link also performs user-specified actions on matched resources. For example, promotions can occur when vacancies exist at the next higher rank level. In another case, some personnel become eligible for certain benefits once they reach a certain length of service. In both these case, links identify the candidates meeting the eligibility criteria. Depending on these criteria and specific node behaviour, the links revise the attributes of personnel undergoing transition in the model database.

23. Both nodes and links are necessary to maintain control of model events. Some user controls in a GeM-derived model are characteristics of the link and other controls are characteristics of the nodes attached to it. For instance, it is node information which identifies the number of vacancies in a certain promotion situation and the size of the pool from which to draw candidates. It is the link which changes the database and updates population counters in attached nodes. With the correct link construct in place, counters attached to the node reflect the number of promotions made.

A Simple Example

24. Consider an entry system that feeds a job classification with trained people. Here a "Level 1" node is associated with this entry state, as depicted in Figure 1. The node may also have attributes associated with it such as age, training level, and education level. An attached link holds the detailed characteristics of new entries. Node attributes describe some features of the people at each promotion level. Nodes can respond to system messages (by "firing" in GeM terminology) to cause database transformations. Suppose that promotion is possible to a "Level 2" node, and from there to a "Level 3" node. Furthermore, suppose that an attrition process draws off some of the personnel in this system, regardless of Level. A node, representing the state of removed staff, will "fire" three links; each of which is attached to one of the staff level nodes.

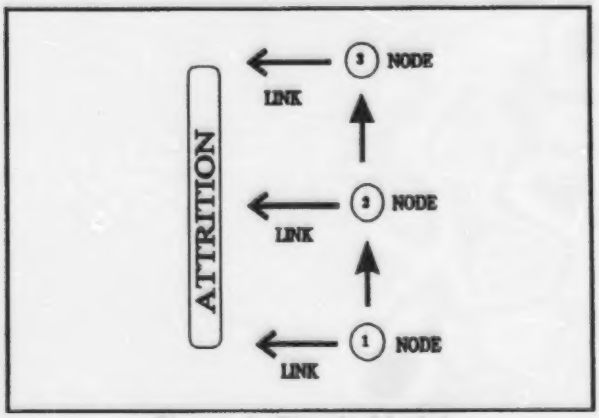

Figure 1: Simple Model

25. In this simple model, the node can fire three attrition links according to some distribution. In complex models, nodes and links enforcing likelihood of leaving by age or years of service may be in place. Via GeM constructs such as these, the model builder adds mechanisms for representing these personnel flows. Attrition links draw off individuals in the three promotion nodes, creating promotion opportunities. Links between the promotion nodes fire to fill these vacancies. At the lowest level a link fires to force recruiting.

Types of Nodes and Links

26. Nodes and links come in several varieties; each of which is appropriate to a particular modelling situation. The precise description of node and link contents, the conventions used for associating nodes to links, and the results observed when each node - link combination is fired are beyond the scope of this research note. However, in brief, they are as follows:

> A "Standard Node" is a representation of a particular state of the resource instance (i.e. a person in HRM models) data base. Nodes are attached to one or more links. Virtually all nodes in the Generic Officer Model are of this type.

An "Age Node" is used to fire "Age Links" (see below).

An "Export Node" is used in conjunction with "Exit Links" (see below) to remove resource instances from the model.

A "Meta Node" is often used with models having multiple resources. Firing a "Meta Node" draws multiple resources to satisfy multiple capacity restraints. This is not used in the Generic Officer Model

A "Push Node" causes a push of resources from the node. This is not used in the Generic Officer Model.

An "Entry Link" creates new resource instances for the model database. It is often used in modelling recruiting processes.

A "Standard Link" is controlled by parameters governing vacancies and capacities of the node object designated in its "Head Node" attribute (the node to which the link may push resources). First, this link creates an eligibility list. Then, it uses the "Head Node" PML and the current staff level to determine the number of staff vacancies. If there is a shortfall, the link tries to fill it by drawing from eligible personnel. It changes the resource attributes (i.e. performs transformations) of any affected personnel in the database.

A "Push Link" is not subject to "Head Node" capacities. It will transform all resources eligible for transformation, subject to the application of refusal probability, regardless of PML and current staff level.

An "Exit Link" which removes personnel from a database is used to model attrition in a personnel system. Using its "Match List" criteria (i.e. a set of criteria which must be satisfied in order to proceed), this link determines which personnel to remove, removes them, and saves their 'personnel records' in a user specified file.

A "Log Link" is used to make copies of individual database records to a user-defined file (but it is not used to change resource attributes). Unlike the "Exit Link", no data are removed from the model. Lists of matching candidates can be produced via a "Log Link". This is an ideal construct for testing how a model is operating.

An "Age Link" is used to move the simulation from one time slice to the next. Through it, the user specifies the attributes to change each model time step and by how much. Examples of commonly adjusted attributes include age, years in classification, and years of service.

An "Import Link" is used to create resource instances (i.e. "new" personnel) whose attributes match the records of an external file. This may be used in modelling individuals who are in the training system but not yet occupationally qualified. This link differs from the "Entry Link" which 'invents', according to user specifications, the attributes of the personnel it creates. "Import Links", in contrast, require the 'real' attributes of those personnel already in the training system. The "Import Link" is also useful in data preparation.

A "Distribution Link" is used to cause a transition within the database where the selected individuals are determined in accord with a distribution (provided by the model designer) based on some relevant attribute(s).

Overlays

27. Problems can arise in other personnel models (such as the D Man A models "DYNAM" and "DYNAMO") when more than one progression process can happen at the same time (as typical modelling systems force staff to be in single state at a time). These various progressions are called "overlays". Doing state transitions to more than one overlay at a time requires a multiplicity of links. Any other overlays superimposed on an existing model quickly make the resulting model unmanageable. GeM avoids this situation by keeping its resources in independent databases. Instead, its nodes contain the counters that reflect the number of entities in the current state. In a well-designed GeM

model, the values of counters in each node and the totals of matching individuals in the database must correspond.

28. In building an application, the modeller should focus on the problem and develop simple representations of the basic aspects of the model. GeM does not force the user to build clean models. Nevertheless, models requiring several overlays would be impossible to create in any other modelling environment.

Rule Bases

29. In more complicated models, a framework of nodes and links may not be sufficient to describe all conditions triggering transformations and the consequences arising from these. In this case, a "Rule Base" describing the conditions can be created. "Rule Bases" are user-designed blocks of Prolog code. The GeM development system permits these blocks to be tied to the link so that this code is part of the link object (often called "binding" in GeM terminology).

30. "Rules Bases" work in conjunction with a goal specified in a link's "operational goal" attribute. When a link's rule base has been properly "bound", the link's "operational goal" is performed and its associated "Head Node" is executed. Alternatively, rule bases can be given their own goal and can be executed independent of node and link structures.

31. During a run, the Generic Officer Model executes several rule bases during each time step. These rule bases specify, for example, the eligibility of officers for FRP, the characteristics of MOC - qualified entrants, the writing of the output reports and the PML at each rank for each year assessed. Often, "Rule Base" contents are critical to the outcome of sponsor-requested assessment runs and therefore they must be documented in the sponsor report package.

Execution Order

32. Before running a model, a node visitation sequence must be specified to assign the order in which nodes are executed. GeM stores the visitation order in

an "Execution List`" structure. Among its attributes are the start and end time slices at which the visitation list is active, and the node list itself. The Generic Officer Model uses three "Execution Lists" for model initialization, for calibration to the fiscal year, and the standard list for the remaining time horizon.

GeM Output

33. GeM reporting makes use of two constructs:

"Output Probes" which examine internal values of objects; and

"Output Finders" which determine the number of matches against one or more user-specified criteria.

Both write their results into internal objects call "Output Holders". Furthermore, output can be directed to text files designated in their "File Name" attribute. They do not transform resources in a data base.

34. "Output Finders" extract information about subsets of the resource instances not already found in node or link data. For example, an "Output Finder" might determine the gender distribution of staff five years into the model run if promotion rules are independent of gender. The "Output Finder" can examine the database looking for males and females according to staff levels even though no specific node or link has this information.

35. "Output Probes" are the more efficient of the two kinds of query object. Probes only examine object counters and do not require an internal "Match List".

III. GENERIC OFFICER MODEL OVERVIEW

Modelling Concept

36. Theoretically, a personnel system can be viewed as a set of progressions. An officer progresses through a series of engagements, say from "short engagement" (SE) to "intermediate engagement" (IE) to "indefinite period of service" (IPS) over a career, as well as progressing through a series of ranks, Lieutenant (Lt) to Captain (Capt) to Major (Maj), etc. The flows in the Generic Officer Model represent personnel related events such as recruiting (flows into the system), promotions and career development (flows within the system), and attrition (flows out of the system).

37. Each member in the personnel system is carefully regulated by distinct policy sets. Individuals, as they flow through the system are subject to these policies and react accordingly. These rules are usually targeted at specific groups of individuals with similar characteristics. Some examples serve to illustrate this point:

a. members on extension are not eligible for promotion;
b. minimum time in rank for promotion to Colonel (Col) is four years; and
c. no officer is to serve past age 55.

These rules are mandated through Canadian Forces Orders, Canadian Forces Administrative Orders or similar legislation. These form the permanent framework of personnel system regulation.

38. In contrast with the above, other "rules" can be mandated for short-term application and are MOC-specific. For example:

a. only seventy percent of officers eligible for IE consideration will be given offers;
b. the PML in 1998 for the Lieutenant-Colonel (LCol) rank is 20 officers; and

c. there will be no promotions to Brigadier General (BGen) this year.

These rules are designed to enhance MOC efficiency within the context of DND economy. The interaction of policies between such simultaneous progressions often present a challenge for personnel managers.

39. Also, from a purely modelling point of view, the personnel-related events can be represented as changes in attributes or characteristics of affected individuals. For example, promotion from one rank to the next is reflected by a change to the rank attribute in that individual's database record (in the model). Expanding on this idea, the Generic Officer Model requires a starting database, with records for each individual in the modelled MOC. This "starting snapshot" often is obtained through the transfer of a selected subset of officer characteristics for the modelled MOC from the Military Personnel Information System (MPIS). Typical characteristics, or attributes, in a model could be age, occupation, and rank.

40. Through application of GeM utility constructs (node and link combinations), the Generic Officer Model, conceptually matches transition events in the personnel system to transition events of person records. Therefore, the Generic Officer Model provides a systems approach to HRM since the faithful representation of transition events allows a fuller understanding of their interactions.

Model Outputs

41. The Generic Officer Model is a time-stepped Monte-Carlo simulation with a time step of one year. This means that the transitions resulting from a rule application capture one year of corresponding personnel system activity. As a by-product of the GeM development framework, flow and capacity counters are associated with the modelling of transition events. These monitor event results. The model queries those counters which contain critical measures of system performance and then outputs the contents (values of the contents at) each time step. The most commonly used model outputs include:

a. the number of officers in each rank;
b. the PML for each rank;
c. the number of MOC - qualified entries by entry plan;
d. the number of engagement releases;
e. the number of voluntary and FRP releases;
f. the number of promotions by rank; and
g. the distribution of officers by years of service.

This information is displayed in graphs generated during the model run.

42. The model generates other useful information including the attributes of officers who have left through engagement or unscheduled releases. These files, often used to verify model performance, hold the characteristics of individuals released through retirement (mandatory or not) and of individuals taking voluntary release or FRP.

Model Inputs

43. Unlike other modelling paradigms, input to the Generic Officer Model is embedded into the executable code. Input is of two types. First, the simulation requires a database containing the characteristics of the personnel in the MOC being modelled. Next, rule bases (blocks of Prolog code) are bound to various model constructs to modify and to extend the simulation's behaviour.

44. The Generic Officer Model uses rule bases which perform the following functions:

a. for model set-up, to associate an MOC code with appropriate personnel data (Entry and counter rule bases are initialized as well as the text file containing the starting personnel database.);
b. to assign all qualified personnel their FRP eligibility status (Officers are denoted FRP eligible if their years of service exceed explicit thresholds. These thresholds, which depend on MOC, MOC subclassification, and rank, are specified in this rule base.);
c. to assign the entry plan and sub-MOC attributes of entries;

d. to carry out engagement conversion;
e. to simulate the merit board process for engagement conversion;
f. to decrement staff counters on the removal of an individual;
g. to organize end of time slice output;
h. to organize promotion eligibility information;
i. to control MOC-specific rules governing recruit entry, specifying the attributes of recruits into this MOC by entry plan and controlling the process that assigns age, years of service and entry rank;
j. to govern time dependent information such as the PMLs for each rank; the numbers of entries by plan; the application of OCDP gates; the application of FRP and its effect on subsequent attrition; the number of promotions to BGen ; minimum and maximum limits to entries (non-committed) and the year(s) of restart; the promotion rates from Lt to Capt; and the unscheduled attrition profiles for the occupation;
k. to contain the processing necessary to generate, scale, and print the graphical output associated with the run;
l. to perform calculations which determine the expected number and standard deviation of voluntary releases by release category; and
m. to contain a MOC specific rules which contain a list of officers to be released in the given year via FRP. (This rule base is often used to calibrate the model's starting data to that just following FRP release.)

45. Once a base-case model has been developed, a Generic Officer Model user is required to examine the consequences of policy changes. To introduce a policy change into an existing model, the user:

a. modifies those rule base files affected by the change;
b. via GeM's rule interpreter, binds affected files to the base case model; and
c. saves the resulting model.

Execution Sequence

46. Time-stepped simulations require, at least initially, a pre-determined sequence of activities to be performed during each time step. The Generic Officer Model uses a sequence of transition events appropriate to the personnel system. When the model executes, or fires, a transition event, it performs the required attribute changes to its population database. It also adjusts appropriate flow and capacity counters to reflect the number of transitions accomplished.

47. The following outlines what happens in the Generic Officer Model at each time slice. Note that the model has a horizon of 15 years. The model starts with time step 0 events which perform data initialization and start-state reporting. Time step 1 handles those events occurring during the partial year remaining to the end of the fiscal year. This event sequence can be longer or shorter than the standard event list for steps 2 to 15.

48. Events are performed in the order shown (provided that the event is used in that time step). The function controlled heading gives the briefest description of the activity performed. This section concludes with an outline of the events arising when these activities fire.

Step 1: Age the Personnel in the Database

Age, time in rank, time in engagement, years of service, and years of commissioned service of all officers currently in the model's database are all incremented by one year.

Step 2: Setup Model Counters and Rules

This step sets model counters and rules such as PML for each rank level, committed intake rates by entry plan, promotion rates to Capt and BGen, engagement conversion gates, engagement conversion refusal rates, and attrition rates.

Step 3: Remove CRA Releases

All personnel are removed from the database who have reached the mandatory retirement age. The attributes of all removed personnel are recorded in a release file (for CRA releases).

Step 4: Remove Other Release Classes

All personnel at the end of their current contract who have not been offered or have refused an applicable extension are removed from the model database. The attributes of all removed personnel are recorded in a release file, which is generated during the run.

Step 5: Flag FRP Releases

Those members about to be released on FRP are flagged. Members so designated are excluded from the estimated attrition calculation.

Step 6: Apply FRP Eligibility

The FRP eligibility criteria (according to MOC) are applied to individuals in the database. Personnel designated are excluded from the estimated attrition calculation. (This step is executed a second time to reset any FRP eligibility designation.)

Step 7: Remove FRP Releases

All officers accepting FRP are removed from the model database. The attributes of all removed personnel are recorded in a release file.

Step 8: Determine Candidates For Attrition

The number of officers in the database who could be eligible for voluntary release is determined. Tables are generated containing the number of candidates with an SE engagement having particular years of commissioned

service values (referring to entry plans) and the number of candidates with (at least) an IE engagement with particular ages (referring to rank). These quantities are required for the expected attrition calculation.

Step 9: Evaluate Expected Attrition

The information calculated in the preceding steps and their corresponding probabilities of voluntary attrition are used to estimate the expected value and standard deviation of voluntary releases. This is used to assess how well the releases in a particular simulation run correspond to actual historical averages.

Step 10: Model FRP Acceptances

FRP acceptance is modelled stochastically. Eligible staff are selected for FRP acceptance through the application of a probability distribution specified in a rule base. (In a Generic Officer Model run where no further FRP reductions are specified, this can be disabled.)

Step 11: Apply Voluntary Attrition

The specified attrition rules are applied for the current time slice for all officers unaffected by FRP. Various personnel attrition rates are applied and these are user-specified distributions which depend on either years of commissioned service or years of service, as appropriate. The user distributions for unscheduled releases in specific MOCs have been based on a 15 year average.

Against each officer record in the database, a random number is drawn. If that number lies below the probability of voluntary release threshold appropriate to that individual's state, then that individual is removed from the model. This method of determining unscheduled releases produces some fluctuation in annual release levels between model runs. Several runs may be necessary to determine an average level of releases, particularly for analyses of

the short-term effects of a policy change. The attributes of all officers removed from the database are contained in an attrition file generated by the model.

Step 12: Prepare Promotion Related Output

This activity generates data to evaluate the size of the promotion pool and the number of releases. The results are collated later in the model to produce corresponding graphs.

Step 13: Carry Out Career Progression - All Ranks Excluding Lt/Capt

The number of vacancies at the various rank levels are determined and filled by promotion. Promotion restrictions, such as minimum times in ranks, are applied.

Step 14: Recruit "Committed Entries"

This step applies if specific numbers of recruits (for a given entry plan) are needed each year. Normally the activities apply to the first five model years of the run. The personnel generated by these activities represent the personnel currently in training for MOC qualification.

Step 15: Carry Out Career Progression for Lt/Capt Ranks

In response to vacancies at the Lt/Capt level, this activity recruits new personnel into the model. Candidates are recruited in response to a user-specified entry plan distribution prescribed in a rule base. This activity is normally disabled during for the first five model years of run to allow the intake of committed entries.

Step 16: Set Up:Random Numbers for New Entries

To ensure fairness of selection during promotion and engagement conversion operations, a random number is assigned to each person in the

model. This is assigned at the beginning of the time step for existing personnel and at this point for personnel new to the database.

Step 17: Determine Personnel Awaiting Engagement Conversion

This activity determines the number of candidates that may be eligible for terms of service conversion. It determines, using the counters ("gates") specified in a rule base, the number of conversion offers to be made for that year.

Step 18: Change Personnel Awaiting Engagement Conversion for Acceptance Cases

This step represents firing multiple nodes (one for each conversion type) which change the awaiting engagement status of successful candidates for engagement conversion. A candidate must be of one "lower" engagement rank, must be in the appropriate years of (commissioned) service range, and must not have not been previously offered that particular terms of service conversion. In a rule base, the user specifies the parameters of a distribution which governs how many individuals (of those offered a particular terms of service contract) who refuse their offers.

Step 19: Calculate Engagement Conversion Refusals

This activity calculates the numbers in the model who have refused engagement conversion for whatever reason.

Step 20: Determine Personnel Awaiting CE and IPS Totals

These activities accumulate the numbers who are awaiting engagement conversion to CE or IPS respectively.

Step 21: Change Engagement Status for All Contract Classes

These activities change the engagement status of those offered and accepting engagement conversion. This only applies to individuals reaching the 9 years of commissioned service mark for IE changes and the 21 years of service mark for the other changes.

Step 22: Output End Slice Information

This activity queries the personnel database to examine the numbers of promotions, current strengths etc.

Step 23: Generate Graphs

This activity prepares graphical output. It extracts all necessary data, titles and scales the graphs, and then prints them.

IV. OBSERVATIONS

49. The Generic Officer Model is an evolving analytical tool. PORT continually responds to sponsor requests to investigate new HRM issues as they arise. This often precipitates further changes to the model, involving the capture and manipulation of personnel attributes or the creation or extension of model overlays. The timeliness of PORT's response to date reflects the principles of modular design embodied in the Generic Officer Model and this arises in turn from the GeM utility's object-oriented approach to model construction.

50. There is a similarity between the many overlays used in the current and earlier versions the Generic Officer Model. The overall design differs because of the grafting of FRP and Engagement Conversion overlays to existing structures. Other changes have been made to process implementation in existing overlays. Nevertheless, these changes are, by the nature of GeM constructs, of limited scope. As long as nodes and links of specified types implement model processing, only well-defined outcomes arise by changing their attributes. This feature inherent in the GeM utility has drastically shortened the time taken for model enhancement and validation. This behaviour differs from the one more commonly seen in HRM models built using other tools where the complete impact of making a change to a model is very difficult to verify.

51. PORT is awaiting further tasking for officer occupation analysis following the completion of the FRP. This may involve unforeseen changes to the model's structure. Pending this further tasking, PORT is investigating the inclusion of costing aspects into this model. This extension could provide insights into the evaluation of cost-related personnel policies such as cost-efficient recruiting and the application of OCDP gates and FRP packages to effect downsizing with

minimum cost. The structures of the Generic Officer Model outlined in this report can be rapidly adapted to these new conditions.

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This research note provides sponsors and analysts with an overview of the Generic Officer Model currently in use by the Personnel Operational Research Team (PORT). This particular model, which was developed using the Generic Modelling (GeM) utility, is now operational in a Windows 95 environment. New features of the Generic Officer Model include the ability to model an Officer Forces Reduction Plan (FRP); an improved model of the Engagement Conversion Process; and the assessment of Run Accuracy. The Generic Officer Model continues to evolve in response to changing personnel policy plans and various other sponsor requirements.

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